A FORECAST OF TECHNOLOGY DEVELOPMENTS

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by

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IBM HARDWARE FORECAST

BACKGROUND: IBM's dominance in large mainframes can hardly be challenged, but its lack luster performance in the mid-range has had significant impact over the past several years. IBM looks to its new offerings, AS/400 and the 9370, to remedy the problem in the mid-range. The dominant factor in achieving success with these products will likely be its ability to support integrated network-based applications solutions and demonstrate the practical value of SAA (Systems Applications Architecture).

1-3 YEAR OUTLOOK:

- IBM looks to the AS/400 as a primary product for smaller customers, as well as a good bet to displace competing departmental systems. The available applications set and SAA support for RPG are big selling points.
- The 9370 languishes for lack of applications portfolio.
- New communications products emerge providing good communications capabilities between all product lines.
- IBM maintains dominance in large systems for commercial applications as well as storage systems without the introduction of SUMMIT, but suffers from slow growth rates in the large systems market.
- PS/2 will meet buyers' expectations in most corporate buying situations and will become the standard business workstation.

3-5 YEAR OUTLOOK:

- Serious movement into image handling products, and additional hardware and software products to lock in IBM's lead in OLTP (On-Line Transaction Processing Systems).
- SAA becomes a reality, allowing IBM to change the hardware architecture for better price performance "under the covers."
- Full set of network products supporting IBM proprietary, as well as emerging international standards.
- Introduction of next generation of large scale processors (SUMMIT).

DEC HARDWARE FORECAST

BACKGROUND: Over the past five years DEC has made considerable inroads in the market for mid-range computers, due chiefly to its integrated VAX architecture, networking capability (especially with IBM processors), and extensive third-party application software.

To continue its success, DEC must extend its current product line beyond the traditional mid-range, supplying low end mainframes and a full range of single- and multi-user microcomputers and workstations.

1-3 YEAR OUTLOOK:

- More functionality will be transferred from boards to proprietary chips for VAX to increase CPU speed, reduce manufacturing costs, and protect proprietary technology designs.

- Toward end of three-year window, DEC may offer a second high-performance architecture, optimized for running UNIX.

- DEC will utilize RISC technology in the next generation VAX to extend the VAX's processing power, and hence, the life cycle.

- DEC will make continued inroads in the IBM communications world through a major transport/interconnection platform.

3-5 YEAR OUTLOOK

- In order to maintain improvements in the price/performance ratio, RISC technology will be incorporated in the first generation of new processors. RISC may offer a link, technology based rather than feature or functionality based, between DEC's new superminicomputers and future generations of business/engineering workstations.

- DEC will need a 64-bit CPU to provide the necessary base for power beyond the limits of its current 32-bit word length VAX CPU.

- After developing a 64-bit CPU, DEC will "shrink" the CPU board to a single chip or set of 3-4 chips.

- To address market needs for increased disk storage capacity for OLTP applications, DEC will increase capacities and broaden its mass storage product line.

ADDITIONAL BACKGROUND INFORMATION:

Now looking to outside RISC technology vendors, having contacted MIPS Computer Systems (Sunnyvale, CA) and Integrated Device Technology (Santa Clara, CA).

BIBLIOGRAPHY:

Digital Review, Various Issues

Computer Systems News, Various Issues

Electronic Business, Various Issues

Datamation, Various Issues

Robertson Colman & Stephens (stock brokerage research) reports

Paine Webber (stock brokerage research) reports

PERIPHERALS/PRINTERS

BACKGROUND: Printers range from serial dot-matrix to page printers with 300 dpi resolution. The primary technologies employed include:

LASER Xerography	Magnetography
Inkjet	Thermal Transfer
Dot Matrix	Daisywheel
Ion Deposition	

1-3 YEAR OUTLOOK:

- LASER printers, such as the HP Laserjet, will continue to grow by significant amounts.
- High functionality printer languages, such as POSTSCRIPT, will become true standards.
- Transputers will be used to provide important performance improvements to the functionally rich printer languages (namely POSTSCRIPT).
- Color will become more predominate as software drivers and standards develop.
- LASER printer resolution will increase beyond the current 300 dpi.
- Prices will continue to be under pressure in high end.

3-5 YEAR OUTLOOK:

- Color LASER printers with good dpi resolution and page rates of 20 ppm or more will be available.
- Page/document handling capabilities, such as sorting, stapling, etc., will become readily available.
- Cut sheet output will be the accepted norm across all hardware platforms.
- Inkjet will challenge the low-end printer market displacing the dot-matrix.

BIBLIOGRAPHY:

CYColor <Mead Imaging>, PC Week, 2/23/88

Color Printers, Infoworld, 2/8/88

Postscript To Share Title, MIS Week, 9/21/87

The Growing Print Impact, Computerworld, 6/22/87

EDI DATA STANDARDS FORECAST

BACKGROUND; Before creation of the American National Standards Institute's Accredited Standards Committee X12, EDI standards were developed by industry associations and corporate users who established "proprietary" formats. There are subsets of the X12 standards for users in various industries (electronics, retail, chemical, et al) and, communications protocols are generally isolated from EDI "document" standards.

"Other" forms of EDI include:

- EDI/EFT, moving value with data. Formats compatible with X12 are Cash Concentration and Disbursement (with addendum), and Cash Trade Exchange.

- Electronic Medical Claims, using formats called UB 82 and HCFA 1500.

- Insurance "Interface" formats called IIR/ACORD established by associations representing independent agents.

1-3 YEAR OUTLOOK:

- Although industry-specific and proprietary standards continue to be used, the trend is towards the more "open" ANSI X12 in addition to earlier standards.

- X12 will "migrate" towards the developing UN endorsed international standard known as EDI For Administration, Commerce and Transportation (EDIFACT), which is supported by the Customs Cooperative Council and international trade bodies.

- Because of the relative maturity of X12 and related standards, EDI in Korea, Australia, New Zealand, and likely elsewhere will adopt them domestically, while EDIFACT continues to develop for international use. European standards share characteristics with EDIFACT and migration there is believed easier..

3-5 YEAR OUTLOOK:

- The X.400 Message Handling Standard will likely emerge as an enveloping structure.

- Adoption of X.400 will facilitate network interconnection and international messaging of all types, and will make possible mixed-mode EDI (graphics, particularly).

ADDITIONAL INFORMATION - STANDARDS IMPACTS ON DEVELOPMENT

- Users surveyed by INPUT averaged their concerns on standards and compatibility at the highest rating with many professing confusion about the status of standards today, particularly regarding the migration of X12 to EDIFACT.

- This perceived unsettled status of EDI standards needs to be addressed through education.

- While some users feel EDI standards are unstable, others acknowledge that software and standards maintenance are likely to be ongoing chores, and count on software vendors to provide updates.

- For the short term, EDI systems need to support those used in the trading cluster, and plan for EDIFACT. X.400 considerations are best handled as a gateway matter, but long term, native internal formats may conform to both EDI structures and X.400 requirements.

ISDN STANDARD

BACKGROUND: The Integrated Services Digital Network (ISDN) is sponsored/promoted by the CCITT (Consultive Committee on International Telegraph and Telephone) of the ITU (International Telecommunications Union). ISDN has general acceptance by national telecommunications authorities (PTTs) and equipment vendors worldwide. There has been greater acceptance in non-U.S. countries due to the emphasis on the use of public (versus private) facilities to meet organizational needs. Lesser acceptance in the U.S. is due to the high use of private networks developed to meet specific needs, lack of defined services, and lack of end-to-end digital connectivity.

ISDN has key strategic significance for IS managers developing systems for the future. ISDN will result in greater data availability and bring increased utility to corporate systems.

1-3 YEAR OUTLOOK

- Short-term efforts will be directed toward continued testing of functionality.
- Limited implementation is expected and only for specific applications, either in narrow geographic areas or within user developed networks.
- Market penetration will not likely exceed 10-15% over the next 1-3 years.
- Initial penetration will be in the form of Centrex services offered by local telephone companies.

3-5 YEAR OUTLOOK

- ISDN will begin to emerge in the 3-5 year horizon.
- Implementations in the form of specifically defined, digital-based services will begin to emerge and the term "ISDN" will begin to fade.
- Corporations will begin to see ISDN as a means of connecting multiple, large networks together.
- Market penetration will not exceed 25-30% during this time frame.

BEYOND 5 YEARS

- The key significance of ISDN will be in the 5-10 year time frame and beyond.

OSI STANDARD

BACKGROUND: Open Systems Interconnect (OSI) is a telecommunications standard developed and sponsored by the International Standards Organization (ISO). Work on OSI is progressing in conjunction with the CCITT. Competing standards to OSI include: MAP (Manufacturing Automation Protocol); TOP (Technical Office Protocol); FTAM (File Transfer Access and Management); MMS (Manufacturing Message System); and TCP/IP (Transmission Control Protocol/ Internet Protocol).

Initiated in 1978, final standards are scheduled for completion by approximately 1992. Most technical work is essentially complete and only formalization needs to be finalized. The standard is endorsed by users in all industry sectors and vendors and replaces old (competing) standards. Most major vendors now have or are developing specific OSI-based products.

The key detractor to speedy implementations is the ability to conduct standardized "conformance testing," a must for testing inter-networking ability. The standard is currently supported by the US government and most foreign national authorities. Foreign regulatory authorities are strong supporters of the OSI standard. As an emerging technology standard, OSI will be a dominant standard by the early-to mid-1990s.

1-3 YEAR OUTLOOK:

- Standard development will continue with the focus on defining the last two layers of a seven-layer structure, scheduled for completion in 1992.
- Major vendors will continue to acknowledge OSI as a key standard but will hold back on major product development efforts.
- Competing standards will continue to exert influence as the final two layers are formalized. Use of other standards will continue to grow.

3-5 YEAR OUTLOOK

- The completed standard is expected by 1992.
- Vendors will begin to complete development and market products to support OSI standards.
- Competing standards will be well entrenched and only limited movement away from these standards should be expected until the latter part of the period, when more users will embrace OSI as the preferred standard.

SAA/STANDARDS

BACKGROUND: Portability of applications between IBM'S three major hardware architectures and operating systems environments has been a significant problem for both users and software vendors. Other vendors, including DEC, HP and Unisys, have been able to make significant in-roads into IBM's mid-range markets, largely due to this problem. These issues and the resulting threat to IBM of large numbers of departmental users defecting all contributed to the announcement of SAA (Systems Applications Architecture) in March of 1987.

Compliance with this standard will, in theory, guarantee portability of applications across existing and future IBM product offerings through standardization on: Common Programming Languages/Interfaces, Common Communications Support, Common User Access, and Common Applications. In essence, this set of standards and products would protect user investments in their applications portfolios.

1-3 YEAR OUTLOOK:

- SAA becomes part of major operating systems releases; i.e., OS/2, AS/400, MVS, and follow-ons.
- IBM will lobby with independent software vendors to support SAA allowing them to develop applications for all major strategic IBM platforms without having to know operating system specifics.
- IBM itself will develop applications (cross-industry and industry-specific) to bring to the market. Expect office automation, manufacturing, insurance, and medical offerings.
- IBM will lobby/join non-profit associations to bring SAA concepts to the fore.
- IBM will initiate a certification activity or process to validate SAA compliance.

3-5 YEAR OUTLOOK:

- Independent software vendors will all adopt some level of compliance with SAA as a means of satisfying demand requirements from IBM customers.
- SAA will blend into other standards proposed by true standards groups such as X-OPEN and OSF which are committed to similar architectural issues across heterogeneous platforms.
- SAA software compliance will grow from 20% to 60% of applications available.
- SAA will have an impact in making the software product market more competitive; yielding more functionality and keeping prices lower.

OPEN SOFTWARE FOUNDATION (OSF)

BACKGROUND: OSF was formed in May, 1988, to develop an alternate UNIX standard in response to a recent agreement between Sun Microsytems and AT&T to rewrite the next "standard" UNIX.

OSF currently consists of eight sponsors (IBM, DEC, H-P, Honeywell Group Bull, Apollo, Nixdorf, Siemens, and most recently N.V. Philips of the Netherlands).

Funding commitments are now in excess of $100 million, based on sponsorship membership requirements of $4.5 million each year for the next three years. In addition, there are now 20 affiliate members. The general membership affiliation fee is $25,000.

A four-man transitional management team is now in place, consisting of senior technical and strategic planning personnel from IBM, DEC, H-P, and Nixdorf.

1-3 YEAR OUTLOOK:

- The first initiative (July 19, 1988) of the OSF was the publication of the its initial RFT (Request for Technology), which is soliciting a graphical user interface technology.

- IBM's yet-to-be released Version 3.0 of AIX will be the core UNIX offering, which will require a license from AT&T for UNIX System V. The original kernel will also include Berkeley 4.3 functions and also be POSIX compliant.

- Unisys, which is also a major player in the UNIX market, is attempting to become a peace-maker between the two camps--AT&T and Sun versus OSF. The company has stated that "Unisys is working in public and behind the scenes to re-unify the industry around a single, vendor-neutral development activity for the UNIX operating system."

- IBM could have a competitive edge with the OSF UNIX standard employing its AIX implementation of UNIX as the core product of OSF UNIX.

- Principal issues which relate to the possible success of OSF include:

  * What will happen to the Sun-AT&T agreement if AT&T joins OSF?

  * Will OSE be able to attract and retain top level UNIX programmers as a non-profit organization which won't be able to provide ownership incentives such as employee stock options?

  * Will there be a problem of software overload from the anticipated large number of contributors, leading to a potentially unwieldy system?

- At this point, it is too early to determine the potential success for such an approach, but it appears that AT&T has been isolated in their approach and that OSF has much of the UNIX industry in its camp, as well as a strong strategic organizational strategy in place, which bodes well for its success. However, it AT&T joins OSF, it would suggest that OSF has succeeding an unstated goal of separating AT&T and Sun Microsystems, and thus have achieved its purpose without actually having to go through with a separate program to implement another UNIX standard. The final question is what will Sun Microsystems do it AT&T joins OSF--it may well be that the balance of power in the UNIX world has tipped to OSF.

CORPORATION FOR OPEN SYSTEMS (COS)

BACKGROUND: COS is a not-for-profit international research and development consortium of 65 national and international computer and communications vendors and major corporate and government users. It includes companies, users and associations such as Citicorp, IBM, Intel, National Bureau of Standards, Hewlett-Packard, Nynex, General Motors, and General Electric.

The purpose of the organization is to provide conformance testing procedures for vendors implementing OSI and ISDN standards as well providing support for implementation of transitional protocols such as MAPs/TOPs programs.

Five separate testing products have been developed to date for the following protocols:

- Internet Protocol
- Transport Protocol
- FTAM (File Transfer and Access Methods)
- MHS (Message Handling Systems--including CCITT X.400 for electronic mail
- Combination

Two of these Conformance Test Systems have been shipped for trial implementation by vendors: an MHS Conformance Test System and an FTAM Conformance Test. None of the tests, however, is at present commercially available. This is expected fairly shortly.

1-3 YEAR OUTLOOK:

- In North America, there are no completing organizations for COS. Although ISO and other international standards groups have their own conformance testing procedures, they tend to be biased more towards the highly structured European regulatory models.

- Conformance testing of communications as well as application standards will become an increasing significant product area over the next three years.

- COS is well positioned, with strong vendor and user sponsor as well as developed product to be the provider of conformance testing product for OSI standards.

- The transition to OSI standards implementation over the next three years will be fueled by the recent advent of Gosip (Government Open System Interconnection Profile).